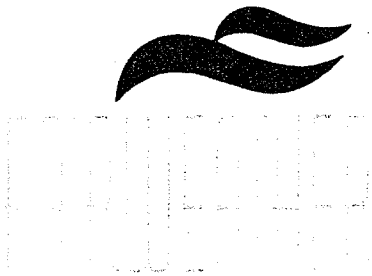
APPENDIX D

HEAVY LIFT RIGGING PLAN



ATLANTIC RICHFIELD COMPANY (ARCO)

REVISED PRC-421 PIER REMOVAL PROJECT

HEAVY LIFT RIGGING

General Information – This plan describes the items to be lifted/handled at the PRC-421 site, the equipment that will perform the operations, the sizing of rigging to attach to the items to be lifted/handled and the requirements for the performance of these operations. The following attachments are a part of this plan:

- Rigging Design Table
- Figure 1-Load Line Barge Equipment Arrangement
- Figure 2-Approximate Arrangement During topsides Removal
- Figure 3-Approximate Arrangement During Nesting
- Figure 4-Approximate Arrangement During Pile Handling, Driving & Platform Lifting
- Manitowoc 4100W Crane Properties and 3 Degree Lift Capacity Charts (7 pages)
- Skagit RB-97 Hoist Winch Properties (1 page)
- DELMAG Diesel Hammer Specification Sheet (1 page)
- Caisson-Type Lead Systems Specification Sheet (1 page)
- USCG *Siuslaw* Load Line Letter (1 page)
- Barge *Siuslaw* Layout Drawing (1 page)
- Barge *Siuslaw* Stability Graph (1 page)
- Barge *Siuslaw* Stability Check (3 pages)
- Catalog Sheet – Crosby Bolt Type Shackles
- Catalog Sheet – Wire Rope Slings
- Catalog Sheet – TUFLEX RoundSlings
- AISC Steel Construction Manual Structural Properties (5 pages)

The first "heavy" items to be lifted will be the concrete encased support piles, or columns, during the "nesting" operations. These columns were built in place by driving four W10X66 web H beams through a template on the sea floor for each of the eight columns. The H beams were then tied together with sucker rod intended for use as reinforcing steel. A sleeve was then lowered over each set of beams and sucker rod that extended from the seafloor template funnel to 18' above mean sea level and the entire column was filled with concrete.

Other "heavy" items to be lifted include the roosting piles and DELMAG pile driver hammer with leads.

Lesser weight items to be lifted include the remnants of the topsides structures and roosting platform assemblies.

All equipment and project components (except quarry rock) will be located on, and work will be conducted from, the Load Line Barge *Siuslaw*.

Please refer to Figure 1 for an approximate layout of equipment on the barge.

Topside Removal Lifting – The demolition and removal of the main deck of the remnant structure will consist of systematically cutting and removing manageable pieces with conventional rigging and cutting equipment. This work will be performed first and will be conducted from the *Siuslaw* positioned to the southwest (offshore) side

of the remnant structure. Individual pieces of support beam, I beam and wooden deck structures will be removed by pre-rigging with a minimum of two mechanical spliced ¾"-6X19 IWRC slings and ¾" alloy shackles rigged in a basket hitch. Sling positioning for each pick will be configured to achieve at least 60 degrees with respect to the horizontal. This arrangement will allow a minimum sling rating of 8.4 tons per pick. Based on the previous facility inspections and the observed degradation of the steel and wooden members it is unlikely that any individual member recovered from the structure will exceed more than two tons in overall weight. By following this specific rigging plan, a four to one safety factor above the sling manufacturers safety factor is built into the design. This arrangement will allow effective, continuous removal operations without requiring time-consuming load calculations. However, as an added resource, tables identifying standard H beam sizes and weights have been included in this section. This information is reprinted from the American Institute of Steel Construction *Steel Construction Manual*, 7th edition (1970). Information from this earlier edition has been used as it may provide a closer match to what was used than later editions.

Please refer to Figure 2 in this Plan for a general equipment configuration for Topsides Removal.

All material removed from the topside will be loaded in bins on the *Siuslaw* (large pieces will be seafastened to the barge deck) for transport to shore and disposal or recycle.

Column Lift Description - The individual column calculated weight in air is 177 tons and is based on an average length of 50' (32' water depth + 18' above mean sea level), four W10X66 steel beams, 525 linear feet of 2.9 lb./ft sucker rod within each column, and a cement weight of 135 lb./cu.ft, as follows:

$W_{(air)} = 4 * 50' * 66\ \#/ft + 525' * 2.9\#/ft + 8^2 * pi/4 * 50' * 135\#/ft^3 = 177$ tons

The calculated weight is based on an intact condition and does not consider concrete degradation that is known to exist, which will reduce the weight. Since the columns will not be lifted above the water surface, it is necessary to estimate the weight in water. An intact column will displace its volume of seawater, or, 2513 cu ft. This is equal to 80.4 tons of seawater.

$V_{(disp)} = 8^2 * pi/4 * 50' = 2513\ ft^3$
$W_{(disp)} = V_{(disp)} * 64\#/ft^3 = 80.4$ tons
$W_{(water)} = W_{(air)} - W_{(disp)} = 177$ tons $- 80.4$ tons $= 96.6$ tons

Since only one end of the column will be lifted during nesting, the weight to be lifted is 96.6/2 = 48.3 tons.

The eight (8) columns will be toppled in rapid succession with the use of explosives. Although the blasting superintendent will recommend the specific locations for the

linear shaped charges to direct the toppling direction as desired, the initial resting position of the columns on the seabed may be random. The Load Line Barge *Siuslaw*, which will be anchored on the southwest (offshore) side of the structure will move approximately 150' away during the detonations, then will relocate approximately over the toppled columns.

Following a survey of the toppled column positions, columns designated for nesting will be established. The nesting process is performed to reduce the overall seabed footprint of the toppled columns. Nesting involves lifting only one end of a column and slowly pivoting it in an arc around the other end that remains on the seabed. Since only one end of the column will be lifted during nesting, the weight to be lifted is 48.3 tons and the rigging will be sized accordingly. A Skagit double-drum hoisting winch, model RB-97 with a line pull of approximately 90 tons, will be used to raise the column end and the barge will maneuver on its winches as necessary to position the column in its desired location. Please see the Rigging Design Table for the size and ratings of all slings and shackles to be used for the nesting.

Once divers have jetted underneath the column to be re-positioned and wrapped the Tuflex sling around the column, it is shackled to the wire from the RB-97. The winch wire is hauled in and the column end is raised a few feet off the seabed. The compliance provided by the barge and buoyancy will soften any dynamic influence of the waves. In a coordinated effort, the barge winches payout and haul in as necessary to move the barge on its anchors to swing the column end.

Refer to Figure 3 in this Plan for a general equipment configuration for nesting.

Pile Handling, Pile Driver, Leads and Platform Assemblies - The piles are nominal 30-inch diameter with a wall thickness of 1½ inches. The piles will be loaded aboard the *Siuslaw* in four (4) 100-foot lengths. Each pile weighs approximately 22.8 tons, in air. In preparation for driving, the piles will be lifted from their horizontal resting position on the *Siuslaw*, rotated to vertical and positioned alongside the *Siuslaw* and lowered to rest on the seabed. Steel struts, projecting from the side of the *Siuslaw* will serve to control alignment and secure the pile prior to attaching the pile driver.

The DELMAG D-150 diesel pile-driving hammer is approximately 22.5 feet in length and weighs 36.4 tons. "Caisson-type" offshore pile leads that guide the hammer with the pile will be used and are pre-attached to the D-150. The combined weight and length of the D-150 and leads is 46.6 tons and 35 feet, respectively.

The Roosting Platform Assemblies, including a 30-inch pile stub, weigh approximately 2½ tons and will be lifted with a 3 point sling. It is proposed to use the same sling design for lifting the Roosting Platforms as was used for Topside Removal Lifting.

Refer to Figure 4 in this Plan for a general equipment configuration during pile handling, driving and lifting Roosting Assemblies. Please see the Rigging Design Table for the size and ratings of all slings and shackles to be used during this phase.

Project Vessels/Equipment - Three vessels will be utilized during the project, which are described as below. Load charts and equipment specifications can be found within this section.

- Load Line Barge *Siuslaw* - The *Siuslaw* is a barge certified by the American Bureau of Shipping for use offshore. It will be moored at the site to support all lifting, pile driving an diving operations. The *Siuslaw* is 240' in Length Overall (LOA) x 60' wide with a hull depth of 16'. The support equipment on the *Siuslaw* consists of:

  Mooring Winches – two double-drum, mounted on deck and each powered by 12VA-71 Detroit Diesel engines rated at 360 hp.with 1500' x 1-1/8" wire on each drum.

  Other Equipment
  Crane – 230 ton Manitowoc 4100W crawler crane. The crane is driven by a Cummins NTA-855 diesel engine rated at 333 hp.

  Auxiliary Lifting Winch – Skagit RB-97, powered by a Detroit 8V-71 diesel. Configured with Pulling capability of 90 tons on the second layer. The winch will be equipped with 300' of 1¾ " 6x37 wire rope with a catalog breaking strength of 153 tons.

  Generator- 37 kw package powered by a 55 hp Izusu 4BG1 diesel engine.

  Welder – 250 amp package powered by a Perkins D3-152 38 hp diesel engine.

  Tool Compressor – 175 cfm package powered by a Deutz F4L1011E 49 hp diesel engine.

- Tug *KAHU*
  The tug *KAHU* will be utilized as the primary tow vessel for the *Siuslaw* and will remain with the *Siuslaw* during its time at site. The *KAHU* is a 72' LOA x 24' wide vessel rated at 2220 horsepower. The vessel is equipped with 2 DDEC-MTU 16/2000 rated 1110 hp main engines.

- Tug *Larcona* - The Tug *Larcona* will be utilized to assist in running anchors and anchor wires during initial mooring operations and to transport quarry rock to and from port and the project site as necessary. The *Larcona* is a 78' LOA x 26' wide vessel rated at 2000 horsepower and is equipped with 2 16V149 GMC main engines and a SMATCO #40-DADT-100 double drum towing winch.

- M/V *Julie* - The *Julie* is a 40' LOA x 13.5' wide line handling tug driven by two Detroit diesel 6-71 engines rated at 400 hp each.

RIGGING DESIGN TABLE (MINIMUM REQUIRED)

Lift Description	Sling(s) Size / Length	Shackle Size / Type	Rigging Weight
Topside Members (~2 tons)	3/4" dia 6X19 IWRC 25' long 2 req'd. (8.4 tons WLL/set in "60° basket configuration)	3/4" Crosby 2130/2150 Bolt Type Alloy Shackle 2 req'd. (4.75 tons WLL each)	70#
Nesting Support Columns (~50 tons each)	Tufflex Roundsling B8E240 X 50' Long 2 req'd.(1 spare) (72 tons WLL each)	1-3/4" Crosby 2130/2150 Bolt Type Alloy Shackle 2 req'd (25 tons WLL each)	350#
Pile Handling (~23 tons each)	1-1/4" dia. 6X37 IWRC 30' long 2 req'd (13 tons WLL each in vertical configuration)	1-1/4" Crosby 2130/2150 Bolt Type Alloy Shackle 2 req'd. (12 tons WLL each)	230#
Pile Driving (~47 tons)	1-3/4" dia. 6X37 IWRC 30' long 2 req'd (25 tons WLL each in vertical configuration)	1-3/4" Crosby 2130/2150 Bolt Type Alloy Shackle 2 req'd. (25 tons WLL each)	470#
Lifting Roosting Platforms (~3 tons)	3/4" dia 6X19 IWRC 25' long 3 req'd. (12.7 tons WLL/set in "60° basket configuration)	3/4" Crosby 2130/2150 Bolt Type Alloy Shackle 3 req'd. (4.75 tons WLL each)	100#